even discusses secondarily, the pathogeny of primary contractures, that of latent lesions, etc.

From this memoir leads a conclusion on which the author, perhaps, does not dwell with sufficient stress: the lesions of the *centrum ovale* and of the convolutions having the same symptomatology. Ought we not to admit with M. Vulpian, that the disorders of cortical origin are due to an irritation of the white fibres of the centrum, expanded in the convolutions, and not on the functionally homogeneous superjacent grey substance?

CHEMISTRY OF THE LIVING FROG'S HEART.—An article on the above subject by Dr. I. Gaule (*Archiv f. Anat. & Phys.*, 1878, III. & IV., p. 291), can be considered, unhesitatingly, as the most important contribution to muscular physiology which has appeared for years. His experiments (performed in the Strasburg Laboratory) refer to the chemical changes which occur in the excised frog's heart during its contractions. The entire organ was attached to Kronecker's double cannla, through which the different fluids employed were passed. During observation the canula communicated with a small mercury-manometer, which registered the contractions on a kymographic cylinder. Each experiment was commenced by passing a current of 0.6 per cent. NaCl. solution through the heart, which as previous observers have found puts the heart into a state of complete diastolic rest, so soon as the last traces of blood are washed away. The results of Gaule's researches are sufficiently precise to be arranged in the form of theorems: 1. A heart which has ceased to contract after a thorough irrigation with 0.6 per cent. NaCl. solution, is recalled into activity by adding to the fluid a trace of sodic hydrate. The most powerful stimulation is obtained by a NaCl. solution containing one part of HNaO. in 20,000. Stronger solutions kill the heart, weaker fluids, down to 1 in 200,000, exert a less stimulant influence. The number of contractions in a given time does not vary, but the height of the contractions increases with the concentration, as is shown by the following table :

One part of HNaO. in 200,000 raised the mercury in the manometer in the average contraction, 3.5mm.

	100,000	6.75
	50,000	10.
	20,000	16.75.

2. When the heart is once charged with a 0.6 per cent. NaCl. solution, containing a given amount of HNaO., the fatigue of the organ manifests itself in the gradual diminution of the hight of the contractions. On refilling the heart with a fresh quantity of this same solution, the strength of the muscle is restored to a certain extent. After a time, however, the heart is completely exhausted and does not respond to a renewed filling. The time requisite varies with each heart, but it is shortened by passing a large quantity of fluid through the heart between each two observations. If, however, the heart is again charged with the fluid, *which has once passed through it*, it is slightly revived. Hence the conclusion, that the work of the heart depends on the potential energy of stored up material, which is dissolved and washed out by the solution passed through the heart.

3. Considerable differences exist in the energy of different hearts, both as to the frequency and force of the contractions. This difference is traceable to the temperature to which the animal was subjected during life. The heart of frogs living in a cold space is always feeble, while the same organ of animals which have been kept in a warm room for several days displays uniformly considerable energy. The amount of energy of a heart depends on the quantity of "combustible" material, since the power of the heart of a cold frog can be raised to the standard of a "warm" frog by feeding the organ with the filtered alkaline extract of a "warm" heart. *The heart can be fed with the material from which the potential energy is derived, in the same manner as an engine is supplied with fuel, and as in the latter case the work done depends on the consumption of fuel.*

4. The filtered extract of the frog's heart contains salts, carbohydrates and albuminoids. The energy, however, of a heart fed with the usual solution of NaCl. and HNaO. containing traces of other salts or carbohydrates (grape-sugar, dextrine, glycogen), is not sensibly increased. Unable to obtain albuminoids free from salts, Gaule employed instead peptone, which was added to the usual solution. This was found to be fully as active as the extract of a "warm" heart. A heart completely exhausted by continued current fluid passed through it, could be again put into a state of maximal energy by feeding it with a solution containing 0.6 per cent. of NaCl., 1-200 per cent. of HNaO. and a trace of pure peptone.

5. On testing the alkalinity of a solution which had remained in the cardiac cavity until the cessation of contractility, it was found, that about one-half of the HNaO. had become neutralized. This was due for the greater part to carbonic acid. A small portion, however, of the alkali was combined with an unknown fixed acid. Different hearts furnished during the persistence of their contractions from 0.40 to 0.80 ccm. carbonic acid. A heart, on the other hand, which does not perform any contractions while charged with NaCl. solution, produces only about one-thirtieth of this quantity of carbonic acid during the same time. Hence the positive conclusion that carbonic acid is produced in the chemical changes accompanying contraction.

From the data furnished by his experiments Gaule calculates, that at least 8 per cent. of the liberated energy of the heart is utilized as mechanical work, while the rest disappears as heat.

In the same journal (p. 263), Dr. Stienor records similar experiments performed in Ludwig's Laboratory (Leipsic). The paper, although very painstaking, is by no means as conclusive as the previous one, but as far as it goes, it fully concurs with Gaule. His conclusions are, that the maintenance of cardiac contractility depends on the presence of a soluble organic matter, probably an albuminoid, while the actual occurrence of contractions demands the stimulus of an alkali. In his experiments the best results were obtained from the presence of 0.5 to 0.1 per cent. of sodic carbonate (which, however, as his figures show, is less stimulating than the sodic hydrate used by Gaule). H. G.